

**LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING (Autonomous)**

L.B. Reddy Nagar, Mylavaram-521230. A.P, INDIA

Affiliated to JNTUK, Kakinada & Approved by AICTE New Delhi  
NAAC Accredited New Delhi & Certified by ISO 9001:2015**DEPARTMENT OF CIVIL ENGINEERING**<http://www.lbrce.ac.in>, [hodcivil@lbrce.ac.in](mailto:hodcivil@lbrce.ac.in) Ph: 08659-222933, Fax: 08659-222931**COURSE HANDOUT**

<b>PROGRAM</b>	: B.Tech., VII-Sem., CE
<b>ACADEMIC YEAR</b>	: 2023-24
<b>COURSE NAME &amp; CODE</b>	: <b>Environmental Pollution Control -20CE25</b>
<b>L-T-P STRUCTURE</b>	: 3-0-0
<b>COURSE CREDITS</b>	: 3
<b>COURSE INSTRUCTOR</b>	: <b>B. NARASIMHARAO</b>
<b>PRE-REQUISITE</b>	: Environmental Studies

**Course Objectives:**

This course deals with importance of meteorology on air pollution, dispersion of air pollutants, air pollution control techniques, impacts of noise pollution on society and reduction of noise pollution. The course also addresses the solid waste management in the society, impacts of hazardous waste flow in society and application of environmental management principles to develop solutions to major environmental problems.

**Course Outcomes (COs):** At the end of the course, the student will be able to:

**CO1:** Describe the fundamentals aspects associated with the generation of air, noise, and solid waste pollution in the society (Understand – L2).

**CO2:** Illustrate the technical aspects of hazardous waste generation and environmental management issues (Understand-L2).

**CO3:** Compute the air pollutant levels from various sources, their dispersions, and calculate the sizing of air pollution control equipment (Apply-L3).

**CO4:** Compute the noise pollution levels from various sources and apply the basic principles to control noise pollution (Apply-L3).

**CO5:** Compute the solid waste generation from various sources and calculate the properties, sizing for treatment and disposal options from solid waste (Apply-L3).

**4. Course Articulation Matrix:**

Course Code	COs	Programme Outcomes												PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
20CE25	CO1	3	-	-	-	-	-	-	-	-	-	-	1	1	-	1
	CO2	3	-	-	-	-	-	-	-	-	-	-	1	1	-	1
	CO3	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
	CO4	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
	CO5	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1

**1 = Slight (Low)    2 = Moderate (Medium)    3-Substantial (High)**

**BoS APPROVED TEXT BOOKS:**

**T1** S.K. Garg, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers, 29<sup>th</sup> Edition, New Delhi, 2014.

**T2** Suresh K. Dhameja, "Environmental Science and Engineering", S.K. Kataria & Sons Publications, New Delhi; 2009.

**BoS APPROVED REFERENCE BOOKS:**

**R1** K.V.S.G. Muralikrishna, "Air Pollution and Control", University Science Press, 2015.

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- R2** H.S. Peavy, D.R. Rowe and G. Tchobanoglous, “Environmental Engineering”, McGraw Hill Publications, Singapore, 1985.
- R3** Environmental Management & Impact Assessment, NPTEL Video Lectures.
- R4** Solid & Hazardous Waste Management, NPTEL Video Lectures

**COURSE DELIVERY PLAN (LESSON PLAN)****UNIT-I: AIR POLLUTION – METEOROLOGY & DISPERSION**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction-History of air pollution	1	03.07.2023		TLM2	
2.	Global air pollution	1	04.07.2023		TLM2	
3.	Primary and secondary air pollutants	1	05.07.2023		TLM2	
4.	Particulate pollutants	1	06.07.2023		TLM2	
5.	Gaseous pollutants	1	07.07.2023		TLM2	
6.	Impact of air pollution on humans	1	10.07.2023		TLM2	
7.	Impact of air pollution on receptors	1	11.07.2023		TLM2	
8.	Meteorological parameters	1	12.07.2023		TLM2	
9.	Meteorological parameters	1	13.07.2023		TLM2	
10.	Wind rose – Lapse rates	1	14.07.2023		TLM2	
11.	Inversion – stack height	1	17.07.2023		TLM4	
12.	Plume rise – Gaussian model	1	18.07.2023		TLM2	
13.	Problems	1	19.07.2023		TLM4	
14.	Problems	1	20.07.2023		TLM4	
15.	Problems	1	21.07.2023		TLM4	
16.	Revision	1	24.07.2023		TLM2	
No. of classes required to complete UNIT-I		16	No. of classes taken			

**UNIT-II: AIR POLLUTION CONTROL TECHNIQUES**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Introduction	1	25.07.2023		TLM2	
18.	Gravity chamber	1	26.07.2023		TLM2	
19.	Cyclone separator	1	27.07.2023		TLM2	
20.	ESP	1	28.07.2023		TLM2	
21.	Bag filter	1	31.07.2023		TLM2	



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22.	Problems	1	01.08.2023		TLM4	
23.	Wet collectors	1	02.08.2023		TLM2	
24.	Venturi scrubber	1	03.08.2023		TLM2	
25.	Spray tower and Cyclone scrubber	1	04.08.2023		TLM4	
26.	Problems	1	07.08.2023		TLM4	
27.	Gaseous control equipment	1	08.08.2023		TLM2	
28.	Absorption and Adsorption	1	09.08.2023		TLM4	
29.	Combustion and Condensation	1	10.08.2023		TLM2	
30.	Problems	1	11.08.2023		TLM2	
31.	Combustion, AAQ standards	1	14.08.2023		TLM2	
32.	Revision	1	16.08.2023		TLM2	
No. of classes required to complete UNIT-II		16	No. of classes taken			

**UNIT-III: NOISE POLLUTION**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Noise pollution basics	1	17.08.2023		TLM2	
34.	Sound and Noise	1	18.08.2023		TLM2	
35.	Power, Intensity and Decibels	1	21.08.2023		TLM2	
36.	Equivalent noise levels, Sound intensity levels	1	22.08.2023		TLM2	
37.	Problems	1	23.08.2023		TLM4	
38.	Sound pressure levels and Weighting networks	1	24.08.2023		TLM2	
39.	Problems	1	25.08.2023		TLM4	
40.	Octane band	1	04.09.2023		TLM2	
41.	Impacts of noise	1	05.09.2023		TLM2	
42.	Noise rating systems	1	07.09.2023		TLM2	
43.	Simple control methods	1	08.09.2023		TLM2	
44.	Revision	1	11.09.2023		TLM2	
No. of classes required to complete UNIT-III		12	No. of classes taken			

**UNIT-IV: SOLID WASTE MANAGEMENT**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	Introduction	1	12.09.2023		TLM2	
46.	SWM Basics	1	13.09.2023		TLM2	



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47.	Composition of solid waste	1	14.09.2023		TLM2	
48.	Properties of solid waste	1	15.09.2023		TLM2	
49.	Problems	1	19.09.2023		TLM4	
50.	Problems	1	20.09.2023		TLM4	
51.	Compaction factor	1	21.09.2023		TLM2	
52.	Collection of solid waste	1	22.09.2023		TLM2	
53.	Litter collection	1	25.09.2023		TLM2	
54.	Processing of solid waste	1	26.09.2023		TLM2	
55.	Composting	1	27.09.2023		TLM2	
56.	Landfill	1	29.09.2023		TLM2	
57.	Problems	1	03.10.2023		TLM4	
58.	Problems	1	04.10.2023		TLM4	
59.	Revision	1	05.10.2023		TLM2	
No. of classes required to complete UNIT-IV		15	No. of classes taken			

**UNIT-V: HAZARDOUS WASTE & ENVIRONMENTAL MANAGEMENT**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
60.	Introduction	1	06.10.2023		TLM2	
61.	Classification of waste	1	09.10.2023		TLM2	
62.	Hazardous waste	1	10.10.2023		TLM2	
63.	Biomedical waste	1	11.10.2023		TLM2	
64.	Plastic waste	1	12.10.2023		TLM2	
65.	E-waste	1	13.10.2023		TLM2	
66.	Treatment storage	1	16.10.2023		TLM2	
67.	Disposal facility	1	17.10.2023		TLM2	
68.	Common effluent treatment plants	1	18.10.2023		TLM2	
69.	Environmental Impact Assessment	1	19.10.2023		TLM2	
70.	Environmental Audit	1	20.10.2023		TLM2	
71.	Environmental Audit	1	24.10.2023		TLM2	
72.	Revision	1	25.10.2023		TLM2	
73.	Revision	1	26.10.2023		TLM2	
74.	Revision	1	27.10.2023		TLM2	
No. of classes required to complete UNIT-V		15	No. of classes taken			

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Teaching Learning Methods					
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Problem Solving	<b>TLM7</b>	Seminars or GD
<b>TLM2</b>	PPT	<b>TLM5</b>	Programming	<b>TLM8</b>	Lab Demo
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Assignment or Quiz	<b>TLM9</b>	Case Study

**EVALUATION PROCESS**

Evaluation Task	Marks
Assignment – 1	A1=5
Assignment – 2	A2=5
I-Mid Examination	M1=15
I-Quiz Examination	Q1=10
Assignment – 3	A3=5
Assignment – 4	A4=5
Assignment – 5	A5=5
II-Mid Examination	M2=15
II-Quiz Examination	Q2=10
Assignment Marks	A=5
Mid Marks	M=15
Quiz Marks	Q=10
<b>Cumulative Internal Examination: A+ +M+Q</b>	<b>30</b>
<b>Semester End Examinations</b>	<b>70</b>
<b>Total Marks</b>	<b>100</b>



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#### PROGRAM OUTCOMES:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural, sciences and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components, processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

- PSO1: Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering
- PSO2: Possesses ability to plan, examine and analyze the various laboratory test required for the professional demands
- PSO3: Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

Course Instructor	Course Coordinator	Module Coordinator	HOD
(B NARASIMHARAO)	(B NARASIMHARAO)	(J RANGAIAH)	(Dr.V.RAMAKRIS HNA)



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## DEPARTMENT OF CIVIL ENGINEERING

### COURSE HANDOUT

#### PART-A

<b>Name of Course Instructor</b>	: Dr.J.Venkateswara Rao	
<b>Course Name &amp; Code</b>	: GREEN BUILDINGS & 20CE29	
<b>L-T-P Structure</b>	: 2-1-0	Credits: 3
<b>Program/Sem/Sec</b>	: B.Tech., CE., VII-Sem.,	A.Y : 2023-24
<b>PRE-REQUISITE</b>	: Environmental science, Environmental Engineering	

**COURSE EDUCATIONAL OBJECTIVES (CEOs):** This Course aims to provide study of appropriate materials for constructing a green building and planning for energy and resource conservation in green buildings. The course also provides the practices of optimum use of renewable energy resources, the principle of the designing the building using climatic factors and planning for effective green building rating system.

**COURSE OUTCOMES (COs):** At the end of the course, students are able to

<b>CO 1</b>	Explain the basic terminology used, different types, benefits of a green building and its rating concept
<b>CO 2</b>	Assess the impact of climate on a building and identify the appropriate materials for constructing a cost-effective green building (Understand – L2)
<b>CO 3</b>	Plan the various options for energy and resource conservation in a green building. (Understand – L2)
<b>CO 4</b>	Identify the ways for optimal use of renewable energy resources in the green building. (Understand – L2)

**COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2					2	2								2
<b>CO2</b>	2					3	3								2
<b>CO3</b>	2					3	3								2
<b>CO4</b>	2					3	3								2

**Note:** Enter Correlation Levels 1 or 2 or 3. If there is no correlation, put '-'

1- Slight (Low), 2 – Moderate (Medium), 3 - Substantial (High).

#### **TEXT BOOKS:**

1. K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, "Alternative building materials and technologies", New Age International, 2014.
2. N. Kumara Swamy and A. Kameswara Rao, "Building Planning and Drawing", Charotar Publications, 2013.



## REFERENCES

1. Abe Kruger and Carl Seville, "Green Building: Principles and Practices in Residential Construction", Demar Cengage Learning, 2012.
2. G.D. Rai, "Non-Conventional Energy Resources", Khanna Publishers; 18th edition, 2017.
3. Koenigsberger O H, "Manual of Tropical Housing and Building", 1st edition, Orient Longman Publishers, Chennai, 2003.
4. Odom P. Eugene, "Ecology and Environment", 2nd edition, Oxford and IBH Publishers, New Dehi, 2005.

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN):

#### UNIT-I: GREEN BUILDINGS CONCEPT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Interaction	1	03-07-23		TLM 1,2	
2.	Interaction	1	04-07-23		TLM 1,2	
3.	Review on environment science basics	1	06-07-23		TLM 1,2	
4.	Review on environment science basics	1	07-07-23		TLM 1,2	
5.	Review on environment science basics	1	10-07-23		TLM 1,2	
6.	Definition of Green Buildings	1	11-07-23		TLM 1,2	
7.	Typical features of green building	1	13-07-23		TLM 1,2	
8.	Benefits and environmental impacts of green building	1	14-07-23		TLM 1,2	
9.	Brown field development	1	15-07-23		TLM 1,2	
10.	Green field development	1	17-07-23		TLM 1,2	
11.	Sustainable site selection	1	18-07-23		TLM 1,2	
12.	Planning of buildings	1	20-07-23		TLM 1,2	
13.	Planning of buildings to maximize comfort	1	21-07-23		TLM 1,2	
14.	Planning of buildings to maximize day lighting and Ventilation	1	22-07-23		TLM 1,2	
15.	Review on Unit-1	1	24-07-23		TLM 1,2	
<b>No. of classes required to complete UNIT-I: 10</b>				<b>No. of classes taken:</b>		

#### UNIT-II: CLIMATE DESIGN

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction about Climatic conditions	1	27-07-23		TLM 1,2	
2.	Local climatic conditions	1	28-07-23		TLM 1,2	



3.	Impact of deforestation	1	31-07-23		TLM 1,2	
4.	Climate change on built environment	1	01-08-23		TLM 1,2	
5.	Climate change desirable conditions	1	03-08-23		TLM 1,2	
6.	Fresh air requirements	1	04-08-23		TLM 1,2	
7.	Fresh air Standards	1	05-08-23		TLM 1,2	
8.	Sick building syndrome	1	07-08-23		TLM 1,2	
9.	Air pollutants	1	08-08-23		TLM 1,2	
10.	Review on Unit-2	1	10-08-23		TLM 1,2	
<b>No. of classes required to complete UNIT-II: 10</b>				<b>No. of classes taken:</b>		

### UNIT-III: GREEN MATERIALS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction about recycling of building materials	1	11-08-23		TLM 1	
2.	Advantages in usage of natural materials	1	14-08-23		TLM 1,2	
3.	Usage of bamboo	1	17-08-23		TLM 1,2	
4.	Timber properties, uses	1	18-08-23		TLM 1,2	
5.	Rammed earth and its advantages	1	19-08-23		TLM 1,2	
6.	Usage of stabilized mud blocks, hollow blocks	1	21-08-23		TLM 1,2	
7.	Usage of lime and lime-pozzolana	1	22-08-23		TLM 1,2	
8.	Materials from agro and industrial waste	1	24-08-23		TLM 1,2	
9.	Usage of ferro-cement and free-concrete	1	25-08-23		TLM 1,2	
10.	Alternative roofing systems	1	26-08-23		TLM 1,2	
11.	I Mid Examinations	1	28-08-23		TLM 1,2	
12.	I Mid Examinations	1	30-08-23		TLM 1,2	
13.	I Mid Examinations	1	31-08-23		TLM 1,2	
14.	I Mid Examinations	1	01-09-23		TLM 1,2	
15.	I Mid Examinations	1	02-09-23		TLM 1,2	
16.	Alternative roofing systems	1	04-09-23		TLM 1,2	
17.	Paints reducing the heat gain of the building	1	08-09-23		TLM 1,2	
18.	Review on Unit-III	1	11-09-23		TLM 1,2	
19.	Review on Unit-III	1	13-09-23		TLM 1,2	
<b>No. of classes required to complete UNIT-III:</b>				<b>No. of classes taken:15</b>		

**UNIT-IV: ENERGY AND RESOURCE CONSERVATION**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction about building envelope	1	15-09-23		TLM 1,2	
2.	Active and passive energy systems	1	16-09-23		TLM 1,2	
3.	Need for energy conservation	1	18-09-23		TLM 1,2	
4.	Various forms of energy used in buildings	1	20-09-23		TLM 1,2	
5.	Building automation and building, management	1	21-09-23		TLM 1,2	
6.	Principle of thermal and lighting	1	22-09-23		TLM 1,2	
7.	Principle of thermal design	1	23-09-23		TLM 1,2	
8.	Energy efficient lighting,	1	25-09-23		TLM 1,2	
9.	Water conservation systems in buildings	1	27-09-23		TLM 1,2	
10.	Water conservation systems in buildings	1	29-09-23		TLM 1,2	
11.	Planning for storm water drainage	1	30-09-23		TLM 1,2	
12.	Water harvesting in buildings	1	04-10-23		TLM 1,2	
13.	Recycling of sewage	1	05-10-23		TLM 1,2	
14.	Waste to energy management in complexes or gated communities	1	06-10-23		TLM 1,2	
15.	Modular wastewater treatment systems for built environment	1	07-10-23		TLM 1,2	
16.	Review on Unit-4	1	09-10-23		TLM 1,2	
<b>No. of classes required to complete UNIT-IV: 15</b>				<b>No. of classes taken:</b>		

**UNIT-V: RENEWABLE ENERGY AND GREEN BUILDING RATING SYSTEMS**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction about wind and Solar Energy	1	11-10-23		TLM 1,2	
2.	Harvesting Potential of solar energy in India and world	1	12-10-23		TLM 1,2	
3.	Construction and operation of various solar based appliances	1	14-10-23		TLM 1,2	

4.	Geothermal energy usage in buildings	1	16-10-23		TLM 1,2
5.	Case study on Geothermal building	1	18-10-23		TLM 1,2
6.	Introduction to LEED	1	19-10-23		TLM 1,2
7.	Green rating system for Integrated Habitat Assessment	1	20-10-23		TLM 1,2
8.	Green rating system for integrated Habitat	1	26-10-23		TLM 1,2
9.	Salient features of Green Buildings Constructed in India	1	27-10-23		TLM 1,2
10.	Review on Unit-5	1	28-10-23		TLM 1,2
<b>No. of classes required to complete UNIT-V: 10</b>				<b>No. of classes taken:</b>	

<b>Teaching Learning Methods</b>			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/ MOOCS)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

### **PART-C**

#### **EVALUATION PROCESS (R20Regulations):**

<b>Evaluation Task</b>	<b>Marks</b>
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
<b>Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))</b>	<b>M=30</b>
<b>Cumulative Internal Examination (CIE): M</b>	<b>30</b>
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

## PART-D

### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO 5</b>	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
<b>PO 6</b>	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
<b>PO 7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAMME SPECIFIC OUTCOMES (PSOs):

<b>PSO 1</b>	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering
<b>PSO 2</b>	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands
<b>PSO 3</b>	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

Title	Course Instructor	Module Coordinator	Head of the Department
Name of the Faculty	Dr. J.Venkateswara Rao	Dr. J.Venkateswara Rao	Dr. V.Rama Krishna
Signature			



# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution

Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada

L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.

Phone: 08659-222933, Fax: 08659-222931

## DEPARTMENT OF CIVIL ENGINEERING

### COURSE HANDOUT

#### PART-A

**Name of Course Instructor:** K. HARISH KUMAR

**Course Name & Code** : Repair and Rehabilitation of Structures & 20CE30

**L-T-P Structure** : 3-0-0

**Credits:** 3

**Program/Sem/Sec** : B.Tech, VII SEM, CE

**A.Y.:** 2023-24

**PREREQUISITE:** CONCRETE TECHNOLOGY

**COURSE EDUCATIONAL OBJECTIVES (CEOs):** This course deals with concepts of various distress and damages to concrete, masonry structures - importance of maintenance of structures - various types and properties of repair materials - damage assessment to the structures using various NDT tests - various repair techniques of damaged structures, corroded structures. The course also consists of Retrofitting components in addition to adapting new techniques in construction practices

**COURSE OUTCOMES (COs):** At the end of the course, student will be able to

<b>CO1</b>	Illustrate the causes for distress and deterioration of structures (Understand – L2)
<b>CO2</b>	Describe the various Non Destructive Tests for condition assessment of structures (Understand – L2)
<b>CO3</b>	Select appropriate repair material and rehabilitation strategy (Understand – L2)
<b>CO4</b>	Conduct survey and apply suitable repair methods for cracks (Understand – L2)

**COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
<b>CO2</b>	3	2	-	-	-	-	-	-	-	-	-	1	-	-	1
<b>CO3</b>	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
<b>CO4</b>	2	1	-	-	-	-	-	-	-	-	-	1	-	-	1
			1 - Low			2 - Medium			3 - High						

**TEXTBOOKS:**

- T1** Concrete Structures-Repair, Rehabilitation and Retrofitting, B. Bhattacharjee, CRS Publishers and Distributors, 2017.
- T2** P. C. Varghese, Maintenance, Repair & Rehabilitation and Minor Works of Buildings”, PHI Learning Pvt. Ltd., 2014

**REFERENCE BOOKS:**

- R1** Concrete Structures-Protection, Repair and Rehabilitation, R.Dodge Woodson, Elsevier, 2009
- R2** B.L. Gupta and Amit Gupta, „Maintenance & Repair of Civil Structures”, Standard Publication, Edition 2009
- R3** CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt. of India Press, New Delhi, 2014.

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN):

#### UNIT-I: DISTRESS IN CONCRETE AND CONDITION SURVEY

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to CO's ,PO's & Basics of Concrete technology	01	03.07.2023		<b>TLM2</b>	
2.	Present repair practices	01	04.07.2023		<b>TLM2</b>	
3.	Distress identification and repair management	01	06.07.2023		<b>TLM2</b>	
4.	Causes of distress in concrete structures	01	07.07.2023		<b>TLM2</b>	
5.	Holistic Models for deterioration of concrete	01	10.07.2023		<b>TLM2</b>	
6.	Permeability of concrete	01	11.07.2023		<b>TLM2</b>	
7.	Aggressive chemical agents, durability aspects	01	13.07.2023		<b>TLM2</b>	
8.	Condition Survey: Objectives, different stages	01	14.07.2023		<b>TLM2</b>	
9.	Preliminary inspection, planning stage, visual inspection	01	15.07.2023		<b>TLM2</b>	
10.	Consideration for repair strategy, need for rehabilitation of structures.	01	17.07.2023		<b>TLM2</b>	
11.	Revision	01	18.07.2023		<b>TLM2</b>	
12.	<b>TUTORIAL-I</b>	01	20.07.2023		<b>TLM3</b>	
<b>No. of classes required to complete UNIT-I: 12</b>				<b>No. of classes taken:</b>		

#### UNIT-II: DETERIORATION OF CONCRETE STRUCTURES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction to détérioration of concrète structures	01	21.07.2023			
14.	Physical processes of deterioration like Freezing and Thawing	01	22.07.2023		<b>TLM2</b>	
15.	Wetting and Drying, Abrasion, Erosion, Pitting	01	24.07.2023		<b>TLM2</b>	
16.	Corrosion – Mechanism	01	25.07.2023		<b>TLM2</b>	
17.	Corrosion – Effect - preventive measures.	01	27.07.2023		<b>TLM2</b>	
18.	Chemical processes like Carbonation	01	28.07.2023		<b>TLM2</b>	
19.	Chloride ingress, Sulphate attack	01	31.07.2023		<b>TLM2</b>	
20.	Alkali aggregate reaction, Acid attack	01	01.08.2023		<b>TLM2</b>	
21.	Cracks in concrete	01	03.08.2023		<b>TLM2</b>	
22.	Type, pattern	01	04.08.2023		<b>TLM2</b>	
23.	Quantification, measurement	01	05.08.2023		<b>TLM2</b>	
24.	Preventive measures	01	07.08.2023		<b>TLM2</b>	
25.	Revision	01	08.08.2023		<b>TLM2</b>	
26.	<b>TUTORIAL-II</b>	01	10.08.2023		<b>TLM3</b>	
<b>No. of classes required to complete UNIT-II: 14</b>				<b>No. of classes taken:</b>		

### UNIT-III: NON-DESTRUCTIVE EVALUATION TESTS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Introduction – NDT tests	01	11.08.2023		TLM2	
28.	Rebound hammer test	01	14.08.2023		TLM2	
29.	Ultrasonic pulse velocity tests	01	16.08.2023		TLM2	
30.	Penetration resistance, pull out tests	01	17.08.2023		TLM2	
31.	Carbonation tests	01	18.08.2023		TLM2	
32.	Chloride content	01	19.08.2023		TLM2	
33.	Corrosion potential assessment cover mete	01	21.08.2023		TLM2	
34.	Half-cell potentiometer test,	01	22.08.2023		TLM2	
35.	Resistivity measurement	01	24.08.2023		TLM2	
36.	Revision	01	25.08.2023		TLM2	
37.	<b>TUTORIAL-III</b>	01	26.08.2023		<b>TLM3</b>	
<b>No. of classes required to complete UNIT-III:11</b>				<b>No. of classes taken:</b>		

### UNIT-IV: SELECTION OF REPAIR MATERIALS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
<b>MID – I Examination</b>		<b>28.08.2023 – 02.09.2023</b>				
38.	Introduction – Repair materials	01	04.09.2023		TLM2	
39.	Various repair materials	01	05.09.2023		TLM2	
40.	Criteria for material selection, Methodology of selection	02	07.09.2023 08.09.2023		TLM2	
41.	Health and safety precautions for handling	01	11.09.2023		TLM2	
42.	Applications of repair materials	01	12.09.2023		TLM2	
43.	Polymer modified mortars and concrete	01	14.09.2023		TLM2	
44.	Gas forming grouts	01	15.09.2023		TLM2	
45.	Epoxy bonding agents	01	16.09.2023		TLM2	
46.	Protective coatings for Concrete and Steel	01	19.08.2023		TLM2	
47.	FRP Sheets	01	21.09.2023		TLM2	
48.	<b>TUTORIAL-IV</b>	01	22.09.2023		<b>TLM3</b>	
<b>No. of classes required to complete UNIT-IV: 12</b>				<b>No. of classes taken:</b>		

### UNIT-V: REPAIR AND REHABILITATION STRATEGIES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
49.	Introduction - Repair strategies	01	23.09.2023		TLM2	
50.	Various methods of crack repair	01	25.09.2023		TLM2	
51.	Grouting, Routing and sealing	01	26.09.2023		TLM2	
52.	Stitching, Autogenous healing, Overlays	02	29.09.2023		TLM2	
53.	Repair to active crack & dormant	01	30.09.2023		TLM2	



	cracks				
54.	RCC jacketing	01	03.10.2023		<b>TLM2</b>
55.	Ferro cement jacketing	01	05.10.2023		<b>TLM2</b>
56.	Fiber wrap technique	01	06.10.2023		<b>TLM2</b>
57.	Strengthening of columns and beams	02	07.10.2023 09.10.2023		<b>TLM2</b>
58.	Case studies of RCC buildings	02	10.10.2023 12.10.2023		<b>TLM2</b>
59.	Case studies of RCC buildings	02	13.10.2023 16.10.2023		<b>TLM2</b>
60.	Case studies of RCC buildings	02	17.10.2023 19.10.2023		<b>TLM2</b>
61.	Revision – Unit 4& 5	02	20.10.2023 24.10.2023		<b>TLM2</b>
62.	Revision – Unit 3	01	26.10.2023		<b>TLM2</b>
63.	Revision – Unit 1 & 2	02	27.10.2023 28.10.2023		<b>TLM2</b>
<b>MID - II Examination</b>		<b>30.10.2023 – 04.11.2023</b>			
<b>No. of classes required to complete UNIT-V: 17</b>				<b>No. of classes taken:</b>	

<b>Teaching Learning Methods</b>			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

### **PART-C**

#### **EVALUATION PROCESS (R17 Regulation):**

<b>Evaluation Task</b>	<b>Marks</b>
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
<b>Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))</b>	<b>M=30</b>
<b>Cumulative Internal Examination (CIE): M</b>	<b>30</b>
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

## PART-D

### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO 4</b>	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO 5</b>	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
<b>PO 6</b>	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO 7</b>	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8</b>	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11</b>	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12</b>	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

### PROGRAMME SPECIFIC OUTCOMES (PSOs):

<b>PSO 1</b>	Possesses necessary skill set to analyse and design various systems using analytical and software tools related to civil engineering
<b>PSO 2</b>	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands
<b>PSO 3</b>	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

<b>Title</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>Head of the Department</b>
<b>Name of the Faculty</b>	<b>KHK</b>	<b>KHK</b>	<b>Dr. JVR</b>	<b>Dr. VRK</b>
<b>Signature</b>				



# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)

Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

## DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

### COURSE HANDOUT

#### PART-A

Name of Course Instructor : Mrs.R.Padma  
Course Name & Code : Utilization of Electrical Energy & 20EE83  
L-T-P Structure : 3-0-0 Credits : 3  
Program/Sem/Sec : B.Tech, CIVIL., VII-Sem. A.Y : 2023-24

**Pre-requisites** : --NIL

**Course Educational Objective:** This course enables the student to familiarize with characteristics of various drives, comprehend the different issues related to heating, welding and illumination.

**COURSE OUTCOMES (COs):** At the end of the course, students are able to

<b>CO 1</b>	Understand mechanism of electric heating and electric welding( <b>Understanding –L2</b> )
<b>CO 2</b>	Analyze performance of various lighting schemes( <b>Understanding –L2</b> )
<b>CO 3</b>	Analyze the performance of electric drive systems( <b>Understanding –L2</b> )
<b>CO 4</b>	Illustrate the different schemes of traction and its main components ( <b>Understanding –L2</b> )
<b>CO5</b>	Understand various tariff methods and power factor improvement techniques ( <b>Understanding –L2</b> )

#### **COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO a	PSO b	PSO c
CO1	2	2	2												
CO2	2	2	2								2				
CO3	2	2	2												
CO4	2	2	2								2				
CO5	2	2	2								2				

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put ‘-’

**1-** Slight (Low), **2** – Moderate (Medium), **3** - Substantial (High).

#### **TEXT BOOKS:**

T1: C.L.Wadhwa “Generation, Distribution and Utilization of Electrical energy, New Age International Publishers,3<sup>rd</sup> Edition,2015.

T2: N.V.Suryanarayana “Utilization of electric power including electric drives and electric traction, New age international publishers New Delhi,2<sup>nd</sup> edition 2014.

#### **REFERENCE BOOKS:**

**R1:** Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.

**R2:** Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.

**Part - B**  
**COURSE DELIVERY PLAN (LESSON PLAN):**

**UNIT-I : ELECTRIC HEATING &WELDING**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, CEO's &CO's	1	03-07-2023		TLM1 &TLM2	
2.	Advantages &applications of Electric heating	1	05-07-2023		TLM1 &TLM2	
3.	Classification of electric heating	1	06-07-2023		TLM1 &TLM2	
4.	Resistance heating	1	07-07-2023		TLM1 &TLM2	
5.	Arc heating	1	10-07-2023		TLM1 &TLM2	
6.	Induction heating	1	12-07-2023		TLM1 &TLM2	
7.	dielectric heating	1	13-07-2023		TLM1 &TLM2	
8.	Causes of failures of heating elements	1	14-07-2023		TLM1 &TLM2	
9.	Materials for heating elements	1	15-07-2023		TLM1 &TLM2	
10.	Requirement of good heating material	1	17-07-2023		TLM1 &TLM2	
11.	ARC Furnace	1	19-07-2023		TLM1 &TLM2	
12.	Resistance welding	1	20-07-2023		TLM1 &TLM2	
13.	Spot welding,seam welding	1	21-07-2023		TLM1 &TLM2	
14.	,Arc welding	1	22-07-2023		TLM1 &TLM2	
15.	Comparision between AC and DC welding	1	24-07-2023		TLM1 &TLM2	
No. of classes required to complete UNIT-I : 15					No. of classes taken:	

**UNIT-II : ILLUMINATION ENGINEERING**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16	Introduction	1	26-07-2023		TLM1/TLM2	
17	Nature of light	1	27-07-2023		TLM1/TLM2	
18	Laws of illumination	1	28-07-2023		TLM1/TLM2	
19	Laws of illumination	1	31.07.2023		TLM1/TLM2	

20	Lighting schemes, sources of light	1	2.08.2023		TLM1/TLM2	
21	Fluorescent Lamp, CFL and LED	1	3.08.2023		TLM1/TLM2	
22	Sodium Vapor Lamp	1	4.8.2023		TLM1/TLM2	
23	Neon lamps	1	5.8.2023		TLM1/TLM2	
24	mercury vapor lamps	1	7.8.2023		TLM1/TLM2	
25	Comparison between tungsten & fluroscnt tubes	1	9.8.2023		TLM1/TLM2	
26	Requirements of good lighting	1	10.8.2023		TLM1/TLM2	
27	Street lighting	1	11.8.2023		TLM1/TLM2	
28	Assignment/Quiz	1	14.8.2023		TLM1	
No. of classes required to complete UNIT-II : 13					No. of classes taken:	

### UNIT-III: ELECTRIC DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29	Introduction	1	16.8.2023		TLM1 &TLM2	
30	Elements of drive, advantages	1	17.8.2023		TLM1 &TLM2	
31	Factors affecting selection of motor	2	18.8.2023 & 19.8.2023		TLM1 &TLM2	
32	Types of loads	1	21.8.2023		TLM1 &TLM2	
33	Industrial applications	1	23.8.2023		TLM1 &TLM2	
34	Transient Characteristics of drives	1	24.8.2023		TLM1 &TLM2	
35	Steady state characteristics of drives	1	25.8.2023		TLM1 &TLM2	
36	Size of motor	1	26.8.2023		TLM1 &TLM2	
37	Load Equalization	1	4.9.2023		TLM1 &TLM2	
38	Assignment/Quiz	1	6.9.2023		TLM1 &TLM2	
No. of classes required to complete UNIT-III : 11					No. of classes taken:	

### UNIT-IV : ELECTRIC TRACTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39	Introduction	1	7.9.2023		TLM1	

40	Requirement of an ideal traction system	1	8.9.2023		TLM1	
41	Supply system for electric traction	1	11.9.2023		TLM1	
42	Train movement	1	13.9.2023		TLM1	
43	mechanism of train movement	1	14.9.2023		TLM1	
44	Traction motors	1	15.9.2023		TLM1	
45	Modern trends in electric traction	1	16.9.2023		TLM1	
46	Automation in traction	1	18.9.2023		TLM1	
47	Speed time curves for different services	1	20.9.2023		TLM1	
48	Trapezoidal and quadrilateral speed time curves	1	21.9.2023		TLM1	
49	Problems on train movement	1	22.9.2023		TLM1	
50	Assignment/quiz	1	23.9.2023		TLM1	
51	Revision	1	25.9.2023		TLM1	
No. of classes required to complete UNIT-IV : 13					No. of classes taken:	

#### **UNIT-V: TARIFF AND POWER FACTOR IMPROVEMENT**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52	Desirable characteristics	1	27.9.2023		TLM1 &TLM2	
53	types	1	29.9.2023		TLM1 &TLM2	
54	Flat rate	1	30.9.2023		TLM1 &TLM2	
55	Block-rate	1	4.10.2023		TLM1 &TLM2	
56	KVA maximum demand	1	5.10.2023		TLM1 &TLM2	
57	Time of Day tariff	1	6.10.2023		TLM1 &TLM2	
58	Disadvantages of low power factor	1	7.10.2023		TLM1 &TLM2	
59	Advantages of improved p.f	1	9.10.2023		TLM1 &TLM2	
60	Improvement devices	1	11.10.2023		TLM1 &TLM2	
61	Power factor improvement using static capacitor	1	12.10.2023		TLM1 &TLM2	
62	Most economical power factor	1	13.10.2023		TLM1 &TLM2	
63	Location of power factor improvement devices from	1	16.10.2023		TLM1 &TLM2	

	consumer					
64	Assignment/Quiz	1	18.10.2023		TLM1	
65	REVISION	-	19.10.2023 TO 2.11.2023		TLM1	
No. of classes required to complete UNIT-V : 13					No. of classes taken:	

#### Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
44	Economic aspects in utilization of electrical energy	2	3.11.2023 & 4.11.2023		TLM1/ TLM2	CO5	T2,R1,R2	

Teaching Learning Methods			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

### PART-C

#### EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	<b>M=30</b>
<b>Cumulative Internal Examination (CIE): M</b>	<b>30</b>
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

#### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

<b>PEO1.</b>	Pursue a successful career in the area of Information Technology or its allied fields..
<b>PEO2.</b>	Exhibit sound knowledge in the fundamentals of Information Technology and apply practical experience with programming techniques to solve real world problems.
<b>PEO3.</b>	Able to demonstrate self-learning, life-long learning and work in teams on multidisciplinary projects.
<b>PEO4.</b>	Able to understand the professional code of ethics and demonstrate ethical behaviour, effective communication, team work and leadership skills in their job.



## PART-D

### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO 5</b>	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
<b>PO 6</b>	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
<b>PO 7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAMME SPECIFIC OUTCOMES (PSOs):

<b>PSO a</b>	Organize, Analyze and Interpret the data to extract meaningful conclusions.
<b>PSO b</b>	Design, Implement and Evaluate a computer-based system to meet desired needs.
<b>PSO c</b>	Develop IT application services with the help of different current engineering tools.

Mrs R.Padma	Dr.AV.G.A.Martanda	Dr.M.S.Giridhar	Dr.J.Siva vara prasad
Course Instructor	Course Coordinator	Module Coordinator	HOD



### COURSE HANDOUT

#### Part-A

**PROGRAM** : B.Tech, VII Sem  
**ACADEMIC YEAR** : 2023-24  
**COURSE NAME & CODE** : Elements of Automobile Engineering-20ME84  
**L-T-P STRUCTURE** : 5 (L) – 0 (T) –0(P)  
**COURSE CREDITS** : 3  
**COURSE INSTRUCTOR** : Kamala Priya B  
**COURSE COORDINATOR** : Dr P Ravindra Kumar  
**PRE-REQUISITES** : Nil

**COURSE EDUCATIONAL OBJECTIVES (CEOs):**The main objective of the course is to familiarize the concepts like lubricating systems, cooling systems, transmission systems, steering system, braking system, suspension system, ignition system, charging system, wheels and tyres, air conditioning and lighting system in automobiles.

#### COURSE OUTCOMES(COs)

After the completion of the course students are able to

- CO1** Label the various components of engine systems and sub-systems of an automobile. **(Remembering-L1)**
- CO2** Comprehend the ignition, charging and starting systems of automobile. **(Understanding-L2)**
- CO3** Outline the features and functions of steering and braking system. **(Understanding-L2)**
- CO4** Describe the transmission system in automobile. **(Understanding-L2)**
- CO5** Identify the safety measures and pollution issues of automobile. **(Remembering-L1)**

#### COURSE ARTICULATION MATRIX(Correlation between COs - POs,PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
<b>CO1</b>	2	2	2	-	-	-	-	-	-	-	-	2	2	-	-
<b>CO2</b>	3	2	-	-	-	-	-	-	-	-	-	2	2	-	1
<b>CO3</b>	1	2	2	-	-	-	-	-	-	-	-	2	2	-	1
<b>CO4</b>	2	1	-	-	-	-	-	-	-	-	-	2	2	-	2
<b>CO5</b>	2	2	-	-	-	-	-	-	-	-	-	2	2	-	2

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put **'-'** 1- Slight(Low), 2 – Moderate(Medium), 3 - Substantial (High).

#### BOS APPROVED TEXTBOOKS:

- T1 Dr.Kirpal Singh, Automobile Engineering-Vol I& II, 13<sup>th</sup>Edition, Standard PublishersDistributors, 2014.
- T2 R.B.Gupta, Automobile Engineering, 8th edition, Tech India publication series, 2013.

#### BOS APPROVED REFERENCE BOOKS:

- R1 V.A.W Hillier and David R.Rogers, Hillier’s Fundamentals of Motor Vehicle Technology, Book1, 5<sup>th</sup>Edition- 2007.
- R2 Heinz Heisler, Advanced Vehicle Technology, 2<sup>nd</sup> Edition, Butterworth-Heinemann Series, 2002.
- R3 David A Crolla, Automotive Engineering, 1<sup>st</sup>Edition, Butterworth-Heinemann series, 2009.

**Part-B**

**COURSE DELIVERY PLAN (LESSON PLAN): Section-A**

**UNIT-I:ENGINE, LUBRICATING SYSTEM AND COOLING SYSTEMS**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	Introduction to CO's and PO's	1	03.07.2023		TLM1/ TLM2	CO1	T1, T2	
2.	<b>Introduction-</b> Basic terminology of engine	1	04.07.2023		TLM1/ TLM2	CO1	T1, T2	
3.	Essential engine components	2	05.07.2023 06.07.2023		TLM1/ TLM2	CO1	T1	
4.	Firing Order	1	10.07.2023		TLM1/ TLM2/	CO1	T1	
5.	Turbo charging	1	11.07.2023		TLM1/ TLM2	CO1	T1	
6.	Functions and need of lubrication system	2	12.07.2023 13.07.2023		TLM1/ TLM2/	CO1	T1, T2	
7.	Functions and need of cooling system	2	15.07.2023 17.07.2023		TLM1/ TLM2	CO1	T2	
8.	methods of lubrication- pressure type	1	18.07.2023		TLM1/ TLM2	CO1	T1, T2	
9.	mist lubrication	1	19.07.2023		TLM1/ TLM2	CO1	T1, T2	
10.	Characteristics of effective cooling system	1	20.07.2023		TLM1/ TLM2	CO1	T1, T2	
11.	types of cooling system	2	22.07.2023 24.07.2023		TLM1/ TLM2	CO1	T1, T2	
12.	thermostat cooling system	1	25.07.2023		TLM1/ TLM2	CO1	T1, T2	
No. of classes required to complete UNIT-I: 15					No. of classes taken:			

**UNIT-II: IGNITION SYSTEM; CHARGING SYSTEM & STARTING SYSTEM**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	<b>IGNITION SYSTEM:</b> Introduction	2	26.07.2023 27.07.2023		TLM1/ TLM2	CO2	T1, T2	
2.	Need of ignition systems	1	01.08.2023		TLM1/ TLM2	CO2	T1, T2	
3.	Types of ignition system- Battery Ignition	2	02.08.2023 03.08.2023		TLM1/ TLM2	CO2	T1, T2	

	system, Magneto Ignition system							
4.	Electronic Ignition system- Capacitive discharge Ignition system	2	05.08.2023 07.08.2023		TLM1/ TLM2	CO2	T1, T2	
5.	Charging and ignition system: Introduction	2	08.08.2023 09.08.2023		TLM1/ TLM2	CO2	T1, T2	
6.	Need of Charging and starting system	2	10.08.2023 14.08.2023		TLM1/ TLM2	CO2	T1, T2	
7.	Starting Motor, Starting drives	2	16.08.2023 17.08.2023		TLM1/ TLM2	CO2	T1	
8.	Bendix drive mechanism	1	19.08.2023		TLM1/ TLM2	CO2	T1	
9.	Solenoid switch	1	21.08.2023		TLM1/ TLM2	CO2	T1	
No. of classes required to complete UNIT-II: 15					No. of classes taken:			

### UNIT-III: STEERING SYSTEM; BRAKING SYSTEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	<b>STEERING SYSTEM:</b> Introduction	1	21.08.2023		TLM1/ TLM2	CO3	T1	
2.	Functions of steering mechanism	1	22.08.2023		TLM1/ TLM2	CO3	T1, T2	
3.	steering gear box types	2	23.08.2023 24.08.2023		TLM1/ TLM2	CO3	T1, T2	
4.	wheel geometry and power steering systems	2	26.08.2023 04.09.2023		TLM1/ TLM2	CO3	T1, T2	
5.	<b>BRAKING SYSTEM:</b> Introduction	1	05.09.2023		TLM1/ TLM2	CO3	T1, T2	
6.	functions of braking system	2	07.09.2023 11.09.2023		TLM1/ TLM2	CO3	T1, T2	
7.	classification of braking system	1	12.09.2023		TLM1/ TLM2	CO3	T1, T2	
8.	Hydraulic braking system- Pneumatic	2	13.09.2023 14.09.2023		TLM1/ TLM2	CO3	T1, T2	

	braking system							
9.	Construction of Antilock braking system	2	16.09.2023 19.09.2023		TLM1/ TLM2	CO3	T1, T2	
10.	operation of Antilock braking system	1	20.09.2023		TLM1/ TLM2	CO3	T1, T2	
No. of classes required to complete UNIT-I: 15					No. of classes taken:			

#### UNIT-IV: TRANSMISSION SYSTEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	<b>TRANSMISSION SYSTEM:</b> Introduction	1	21.09.2023		TLM1/ TLM2	CO4	T1, T2	
2.	Types of gear boxes	2	23.09.2023 25.09.2023		TLM1/ TLM2	CO4	T1, T2	
3.	functions and types of front and rear axles,	2	26.09.2023 27.09.2023		TLM1/ TLM2	CO4	T1, T2	
4.	types and functions	1	30.09.2023		TLM1/ TLM2	CO4	T1, T2	
5.	components of the clutches	2	03.10.2023 04.10.2023		TLM1/ TLM2	CO4	T1, T2	
6.	fluid couplings	1	05.10.2023		TLM1/ TLM2	CO4	T1, T2	
7.	design considerations of Hotchkiss drive torque tube drive	3	07.10.2023 09.10.2023 10.10.2023		TLM1/ TLM2	CO4	T1, T2	
8.	function and parts of differential and traction control.	2	11.10.2023 12.10.2023		TLM1/ TLM2	CO4	T1, T2	
No. of classes required to complete UNIT-I:14					No. of classes taken:			

#### UNIT-V: SAFETY MEASURES OF AN AUTOMOBILE; AUTOMOBILE POLLUTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	<b>SAFETY MEASURES OF AN AUTOMOBILE:</b> Introduction	1	14.10.2023		TLM1/ TLM2	CO5	T1, T2	
2.	Safety belt, Airbags	1	16.10.2023		TLM1/ TLM2	CO5	T1	

3.	wind screen wipers, rear vehicle cameras	2	17.10.2023 18.10.2023		TLM1/ TLM2	CO5	T1		
4.	bumper design safety	1	19.10.2023		TLM1/ TLM2	CO5	T2		
5.	<b>AUTOMOBILE POLLUTION:</b> Emissions from Automobiles	2	21.10.2023 24.10.2023		TLM1/ TLM2	CO5	T1, T2		
6.	Nitrogen oxides, Soot	1	25.10.2023		TLM1/ TLM2	CO5	T1, T2		
7.	Carbon monoxide, Hydrocarbons	1	26.10.2023		TLM1/ TLM2	CO5	T1, T2		
8.	Particulates, Emission Regulations	1	28.10.2023		TLM1/ TLM2	CO5	T1, T2		
No. of classes required to complete UNIT-I: 10					No. of classes taken:				

**CONTENTS BEYOND THE SYLLABUS:**

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign
1.	Sensors in Electric Vehicle Latest trends in wheels and tires, Plug in Hybrid Electric Vehicles	1	28.10.2023		TLM1/ TLM2	CO1 -CO5	T1, T2, R1 to R5	

Teaching Learning Methods			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

#### ACADEMIC CALENDAR:

Description	From	To	Weeks
<b>Commencement of Class Work: 21.02.2022</b>			
<b>I Phase of Instructions</b>	03.07.2023	26.08.2023	8
<b>I Mid Examinations</b>	28.08.2023	02.09.2023	1
<b>II Phase of Instructions</b>	04.09.2023	28.10.2023	8
<b>II Mid Examinations</b>	30.10.2023	04.11.2023	1
<b>Preparation and Practical</b>	06.11.2023	11.11.2023	1
<b>Semester End Examinations</b>	13.11.2023	25.11.2023	2

#### Part - C

#### EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment – Cycle -I	1,2,3	A1=05
Quiz – 1	1,2,3	Q1=10
Assignment – Cycle -II	3,4,5	A2=05
Quiz – 2	3,4,5	Q2=10
I-Mid Examination	1,2,3	B1=15
II-Mid Examination	3,4,5	B2=15
Evaluation of Assignment/Quiz Marks: A=(Cycle -I + Cycle - II)/2	1,2,3,4,5	<b>A=05</b>
Evaluation of Mid Marks: B=80% of Max (B1, B2) + 20% of Min(B1, B2)	1,2,3,4,5	<b>B=20</b>
<b>Cumulative Internal Examination: A+B+Q</b>	<b>1,2,3,4,5</b>	<b>A+B+Q=30</b>
<b>Semester End Examinations: E</b>	<b>1,2,3,4,5</b>	<b>E=70</b>
<b>Total Marks: A+B+Q+E</b>	<b>1,2,3,4,5</b>	<b>100</b>



**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):**

**PEO1:** To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.

**PEO2:** To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.

**PEO3:** To develop inquisitiveness towards good communication and lifelong learning.

**PROGRAMME OUTCOMES (POs):**

**Engineering Graduates will be able to:**

**1.Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**2.Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**3.Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**4.Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**5.Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

**6.The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to professional engineering practice.

**7.Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**8.Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

**9.Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**10.Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**11.Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**12. Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAMME SPECIFIC OUTCOMES (PSOs):**

**PSO1:** To apply the principles of thermal sciences to design and develop various thermal systems.

**PSO2:** To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.

**PSO3:** To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

<b>Position</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>HOD</b>
<b>Name</b>	Kamala Priya B	Dr. P.Ravindra Kumar	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy
<b>Signature</b>				





# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution

Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada

L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.

Phone: 08659-222933, Fax: 08659-222931

## DEPARTMENT OF CIVIL ENGINEERING

### COURSE HANDOUT

#### PART-A

**Name of Course Instructor:** Mr.S.Srinivasa Reddy, Sr Assistant Professor

**Course Name & Code** : MANAGEMENT SCIENCE FOR ENGINEERS & 20HS02 **Regulation:** R20

**L-T-P Structure** : 3-0-0 **Credits:** 03

**Program/Sem/Sec** : B.Tech VII Sem (A) **A.Y.:** 2023-2024

**PREREQUISITE:** Professional ethics and human values

#### **COURSE EDUCATIONAL OBJECTIVES (CEOs):**

1. To make students understand management, its principles, contribution to management, organization, and its basic issues and types.
2. To make students understand the concept of plant location and its factors and plant layout and types, method of production and work study importance.
3. To understand the purpose and function of statistical quality control. And understand the material management techniques.

**COURSE OUTCOMES (COs):** At the end of the course, student will be able to

<b>CO1</b>	Understand management principles to practical situations based on the organization structures. (L2)
<b>CO2</b>	Design Effective plant Layouts by using work study methods. (L2)
<b>CO3</b>	Apply quality control techniques for improvement of quality and materials management. (L3)
<b>CO4</b>	Develop best practices of HRM in corporate Business to raise employee productivity. (L2)
<b>CO5</b>	Identify critical path and project completion time by using CPM and PERT techniques. (L3)

**COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	-	-	-	-	-	-	2	2	-	-	3	-	-	-
<b>CO2</b>	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
<b>CO3</b>	-	3	-	-	-	-	-	-	-	-	-	3	-	-	-
<b>CO4</b>	-	-	-	-	-	-	-	3	2	-	-	3	-	-	-
<b>CO5</b>	-	-	-	-	-	-	-	-	-	-	2	3	-	-	-
	<b>1 - Low</b>				<b>2 -Medium</b>				<b>3 - High</b>						

<b>PSO 1</b>	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering.
<b>PSO 2</b>	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands.
<b>PSO 3</b>	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain.

**TEXTBOOKS:**

**T1** Dr. A.R.Aryasri, Management Science, TMH, 10th edition, 2012

**REFERENCE BOOKS:**

**R1** Koontz & wehrich – Essentials of management, TMH, 10th edition, 2015

**R2** Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004

**R3** O.P. Khana, Industrial engineering and Management L.S.Srinath, PERT & CPM

**PART-B****COURSE DELIVERY PLAN (LESSON PLAN): Section - A****UNIT-I: INTRODUCTION**

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Management-Nature and Importance	1	03-07-2023		TLM1/TLM2	
2.	Management functions	1	05-07-2023		TLM1/TLM2	
3.	Contributions of Taylor, Fayol	1	05-07-2023		TLM1/TLM2	
4.	Contribution of Elton Mayo	1	06-07-2023		TLM1/TLM2	
5.	Maslow's & Herzberg's Two Factor Theory	1	07-07-2023		TLM1/TLM2	
6.	Douglas McGregor	1	10-07-2023		TLM1/TLM2	
7.	Basic Concepts of Organization-Authority	1	12-07-2023		TLM1/TLM2	
8.	Responsibility Delegation of Authority	1	12-07-2023		TLM1/TLM2	
9.	Departmentation and Decentralization	1	13-07-2023		TLM1/TLM2	
10.	Span of Control	1	14-07-2023		TLM1/TLM2	
11.	Line, Line and Staff organizations	1	17-07-2023		TLM1/TLM2	
12.	Functional, Committee	1	19-07-2023		TLM1/TLM2	
13.	Matrix Organizations	1	19-07-2023		TLM1/TLM2	
14.	Quiz-I	1	20-07-2023		TLM1/TLM2	
<b>No. of classes required to complete UNIT-I: 14</b>				<b>No. of classes taken:</b>		

**UNIT-II: OPERATIONS MANAGEMENT**

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Plant location	1	21-07-2023		TLM1/TLM2	
16.	Factors influencing location	1	24-07-2023		TLM1/TLM2	
17.	Principles	1	26-07-2023		TLM1/TLM2	
18.	Types of plant layouts	1	26-07-2023		TLM1/TLM2	
19.	Methods of production (job, batch production)	1	27-07-2023		TLM1/TLM2	
20.	Mass production	1	28-07-2023		TLM1/TLM2	
21.	Work study - Basic procedure	1	31-07-2023		TLM1/TLM2	

	involved in method study and Work measurement					
22.	Work study - Basic procedure involved in method study and Work measurement	1	02-08-2023		TLM1/TLM2	
23.	Quiz-II	1	02-08-2023		TLM1/TLM2	
<b>No. of classes required to complete UNIT-II: 09</b>				<b>No. of classes taken:</b>		

### UNIT-III: STATISTICAL QUALITY CONTROL, MATERIALS MANAGEMENT

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Statistical quality control Introduction	1	03-08-2023		TLM1/TLM2	
25.	Concept of Quality & Quality Control	1	04-08-2023		TLM1/TLM2	
26.	Functions, Meaning of SQC	1	07-08-2023		TLM1/TLM2	
27.	Variables and attributes	1	09-08-2023		TLM1/TLM2	
28.	X chart	1	09-08-2023		TLM1/TLM2	
29.	R Chart	1	10-08-2023		TLM1/TLM2	
30.	C Chart	1	11-08-2023		TLM1/TLM2	
31.	P Chart	1	14-08-2023		TLM1/TLM2	
32.	Simple Problems	1	16-08-2023		TLM1/TLM2	
33.	Acceptance sampling	1	16-08-2023		TLM1/TLM2	
34.	Sampling plans	1	17-08-2023		TLM1/TLM2	
35.	Deming's contribution to quality	1	18-08-2023		TLM1/TLM2	
36.	Materials management	1	21-08-2023		TLM1/TLM2	
37.	Meaning and objectives	1	23-08-2023		TLM1/TLM2	
38.	Inventory control	1	23-08-2023		TLM1/TLM2	
39.	Need for inventory control	1	24-08-2023		TLM1/TLM2	
40.	Purchase procedure	1	25-08-2023		TLM1/TLM2	
41.	Store records	1	04-09-2023		TLM1/TLM2	
42.	EOQ, ABC analysis	1	07-09-2023		TLM1/TLM2	
43.	Stock levels	1	08-09-2023		TLM1/TLM2	
44.	Quiz-3	1	11-09-2023		TLM1/TLM2	
<b>No. of classes required to complete UNIT-III: 15</b>				<b>No. of classes taken:</b>		

### UNIT-IV: HUMAN RESOURCE MANAGEMENT (HRM)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	Concepts of HRM	1	13-09-2023		TLM1/TLM2	
46.	Basic functions of HR manager	1	13-09-2023		TLM1/TLM2	
47.	Man power planning	1	14-09-2023		TLM1/TLM2	
48.	Recruitment	1	15-09-2023		TLM1/TLM2	
49.	Selection	1	20-09-2023		TLM1/TLM2	

50.	Training and development	1	20-09-2023		TLM1/TLM2	
51.	Placement	1	21-09-2023		TLM1/TLM2	
52.	Wage and salary administration	1	22-09-2023		TLM1/TLM2	
53.	Wage and salary administration	1	25-09-2023		TLM1/TLM2	
54.	Promotion	1	27-09-2023		TLM1/TLM2	
55.	Transfers Separation	1	27-09-2023		TLM1/TLM2	
56.	Performance appraisal	1	29-09-2023		TLM1/TLM2	
57.	Job evaluation and merit rating	1	04-10-2023		TLM1/TLM2	
58.	Quiz-4	1	04-10-2023		TLM1/TLM2	
<b>No. of classes required to complete UNIT-IV: 14</b>				<b>No. of classes taken:</b>		

### UNIT-V: PROJECT MANAGEMENT

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
59.	Introduction	1	05-10-2023		TLM1/TLM2	
60.	Early techniques in project management	1	06-10-2023		TLM1/TLM2	
61.	Network analysis	1	09-10-2023		TLM1/TLM2	
62.	Programme Evaluation and Review Technique (PERT)	1	11-10-2023		TLM1/TLM2	
63.	Problems	1	11-10-2023		TLM1/TLM2	
64.	Critical path method (CPM)	1	12-10-2023		TLM1/TLM2	
65.	Identifying critical path	1	13-10-2023		TLM1/TLM2	
66.	Problems	1	16-10-2023		TLM1/TLM2	
67.	Problems	1	18-10-2023		TLM1/TLM2	
68.	Probability of completing project within given time	1	18-10-2023		TLM1/TLM2	
69.	Project cost analysis	1	19-10-2023		TLM1/TLM2	
70.	Problems	1	25-10-2023		TLM1/TLM2	
71.	project crashing	1	25-10-2023		TLM1/TLM2	
72.	Simple problems	1	26-10-2023		TLM1/TLM2	
73.	Simple problems	1	27-10-2023		TLM1/TLM2	
<b>No. of classes required to complete UNIT-V: 14</b>				<b>No. of classes taken:</b>		

Teaching Learning Methods			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

### PART-C

#### EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15

I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

## PART-D

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

<b>PEO 1</b>	To possess knowledge in both fundamental and application aspects of mathematical, scientific, engineering principles to analyze complex engineering problems for meeting the national and international requirements and demonstrating the need for sustainable development.
<b>PEO 2</b>	To adapt to the modern engineering tools for planning, analysis, design, implementation of analytical data and assess their relevant significance in societal and legal issues necessary in their professional career.
<b>PEO 3</b>	To exhibit professionalism, ethical attitude, communication, managerial skills, team work and social responsibility in their profession and adapt to current trends by engaging in continuous learning.

### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO 5</b>	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
<b>PO 6</b>	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
<b>PO 7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

<b>PO 10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### **PROGRAMME SPECIFIC OUTCOMES (PSOs):**

<b>PSO 1</b>	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering.
<b>PSO 2</b>	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands.
<b>PSO 3</b>	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain.

<b>Title</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>Head of the Department</b>
<b>Name of the Faculty</b>	Mr.S.Srinivasa Reddy	Mr. A.Nageswara Rao	Dr.M.B.S.Sreekara Reddy	Dr.S.Pichi Reddy
<b>Signature</b>				







# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)

Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

## DEPARTMENT OF CIVIL ENGINEERING

Name of Course Instructors	: Mr. Sasi Bhushan K
Course Name & Code	: 20CES3 - IOT Applications in Civil Engineering
L-T-P Structure	: 1-0-3
Credits	: 3
Program	: B.Tech.,
Branch / Class / Section	: CIVIL - VII Semester
A.Y	: 2023 - 24

### Pre-requisites: Python Programming lab

**Course Educational Objectives:** In this course, student will be exposed to implement interfacing of various sensors with Arduino/Raspberry Pi to transmit data wirelessly between different devices.

**Course Outcomes: (COs):** At the end of the course, students are able to:

- CO 1 : Understand the basics of Microcontroller, Arduino-Uno, RaspberryPi and Internet of Things (**Understand-L2**)
- CO 2 : Apply the steps of the design methodology in developing IoT Applications using Arduino-Uno, RaspberryPi (**Understand-L2**)
- CO 3 : Design the interfacing of various sensors with Arduino and Raspberry Pi (**Apply-L3**)
- CO 4 : Adapt effective Communication, presentation and report writing skills (**Apply – L3**)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	2	-	-	-	-	-	-	1			
CO2	2	3	3	2	3	-	-	-	-	-	-	2			
CO3	2	3	3	2	3	-	-	-	-	-	-	2			
CO4	-	-	-	-	-	-	-	-	2	2	-	-			
			1 - Low					2 - Medium				3 - High			

### TEXTBOOK:

1. Raj Kamal, Internet of Things - Architecture and Design Principles, McGraw Hill Publication, 2017.
2. Zach Shelby, Carsten Bormann: "The Wireless Embedded Internet", Wiley, 1st Edition.

### REFERENCES:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things – A Hands-on Approach, University Press, 2015
2. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford Press.

### HANDS – ON Laboratory Sessions:

1. Introduction to 8051 Microcontroller, ATmega328P - Arduino Uno and Raspberry Pi
2. Programming the Microcontroller, Arduino and Raspberry Pi
3. Stepper Motor Control with 8051 Microcontroller
4. Interfacing of LED, DHT11-humiditysensor and PIR sensor with Arduino and RaspberryPi using Python Program
5. Traffic Light Simulator using Arduino and RaspberryPi.
6. Water flow sensor with an Arduino board.
7. Ultrasonic sensor using Arduino board
8. RaspberryPi Motion Sensor Alarm using PIR Sensor
9. RaspberryPi based Smart Phone Controlled Home Automation
10. DC Motor Control with RaspberryPi
11. Stepper Motor Control with RaspberryPi
12. InterfacingDS18B20TemperatureSensorwithRaspberryPi

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN):

<b>IoT Basics</b>						
S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to 8051 Microcontroller, ATmega328P - Arduino Uno and Raspberry Pi	1	06-07-2023		TLM5	
2.	Programming the Microcontroller, Arduino and Raspberry Pi	1	13-07-2023		TLM5	
3.	Stepper Motor Control with 8051 Microcontroller	1	20-07-2023		TLM5	
4.	Interfacing of LED, DHT11-humiditysensor and PIR sensor with Arduino and RaspberryPi using Python Program	1	27-07-2023		TLM5	
5.	Traffic Light Simulator using Arduino and RaspberryPi.	1	03-08-2023		TLM5	
6.	Water flow sensor with an Arduino board.	1	10-08-2023		TLM5	
7.	Ultrasonic sensor using Arduino board	1	17-08-2023		TLM5	
8.	RaspberryPi Motion Sensor Alarmusing PIR Sensor	1	24-08-2023		TLM5	
9.	RaspberryPi based Smart PhoneControlled Home Automation	1	07-09-2023		TLM5	
10.	DC Motor Control with RaspberryPi	1	14-09-2023		TLM5	
11.	Stepper Motor Control withRaspberryPi	1	21-09-2023		TLM5	
12.	InterfacingDS18B20TemperatureSensorwithRaspberryPi	12	28-09-2023		TLM5	

### **Hands – on Laboratory Session**

S.No.	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to 8051 Microcontroller, ATmega328P - Arduino Uno and Raspberry Pi	3	06-07-2023		TLM2	
2.	Programming the Microcontroller, Arduino and Raspberry Pi	3	13-07-2023		TLM8	
3.	Stepper Motor Control with 8051 Microcontroller	3	20-07-2023		TLM8	
4.	Interfacing of LED, DHT11-humiditysensor and PIR sensor with Arduino and RaspberryPi using Python Program	3	27-07-2023		TLM8	
5.	Traffic Light Simulator using Arduino and RaspberryPi.	3	03-08-2023		TLM8	
6.	Water flow sensor with an Arduino board.	3	10-08-2023		TLM8	
7.	Ultrasonic sensor using Arduino board	3	17-08-2023		TLM8	
8.	RaspberryPi Motion Sensor Alarmusing PIR Sensor	3	24-08-2023		TLM8	
9.	RaspberryPi based Smart PhoneControlled Home Automation	3	07-09-2023		TLM8	
10.	DC Motor Control with RaspberryPi	3	14-09-2023		TLM8	
11.	Stepper Motor Control withRaspberryPi	3	21-09-2023		TLM8	
12.	InterfacingDS18B20TemperatureSensor withRaspberryPi	3	28-09-2023		TLM8	
<b>No.of classes required to complete:</b>		<b>36</b>	<b>No.of classes conducted:</b>			

### PART-C

<b>Teaching Learning Methods</b>					
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Problem Solving	<b>TLM7</b>	Seminars or GD
<b>TLM2</b>	PPT	<b>TLM5</b>	Programming	<b>TLM8</b>	Lab Demo
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Assignment or Quiz	<b>TLM9</b>	Case Study

<b>Academic Calendar : B.Tech., VII-Sem., 2023-24</b>			
Description	From	To	Weeks
<b>Commencement of Class work: 03-07-2023</b>			
I Phase of Instructions	03-07-2023	26-08-2023	<b>8 W</b>
I MID Examinations	28-08-2023	02-09-2023	<b>1 W</b>
II Phase of Instructions	04-09-2023	28-10-2023	<b>8 W</b>
II MID Examinations	30-10-2023	04-11-2023	<b>1 W</b>
Preparation and Practicals	06-11-2023	11-11-2023	<b>1 W</b>
Semester End Examinations	13-11-2023	25-11-2023	<b>2 W</b>

<b>Evaluation Process</b>		
Evaluation Task	COs	Marks
Day to Day work	1,2,3,4	<b>A1=10</b>
Internal Lab Examination	1,2,3,4	<b>B=5</b>
<b>Total Internal Marks: [A+B]</b>		<b>C=15</b>
<b>Semester End Examinations</b>	1,2,3,4	<b>D=35</b>
<b>Total Marks: [C+D]</b>	1,2,3,4	<b>50</b>

## PART – D

### PROGRAMME OUTCOMES (POs):

<b>PO 1:</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2:</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3:</b>	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
<b>PO 4:</b>	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
<b>PO 5:</b>	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
<b>PO 6:</b>	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
<b>PO 7:</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8:</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9:</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10:</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11:</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12:</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### PROGRAMME SPECIFIC OUTCOMES (PSOs):

<b>PSO 1:</b>	<b>Communication:</b> Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
<b>PSO 2:</b>	<b>VLSI and Embedded Systems:</b> Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
<b>PSO 3:</b>	<b>Signal Processing:</b> Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor

Course Coordinator

Module Coordinator

HOD

[Mr. K.SASI BHUSHAN]

[Mr. K.SASI BHUSHAN]

[Dr.P.LACHI REDDY]

[Dr.Y. AMAR BABU]